2007 RESEARCH PROBLEM STATEMENT

Problem Title: Seismic Isolation Bearings for Accelerated Bridge Construction **No.:** 07.08-9

Submitted By: Keri Ryan and Hugh Boyle **Email:** kryan@cc.usu.edu

Project Champion: Ray Cook

(UDOT or FHWA employee who needs this research done, will help the Research Division lead this project, and will spearhead the implementation of the results. If the project gets prioritized at the UTRAC conference, a Champion Commitment Form will be required before funding.)

1. Briefly describe the problem to be addressed.

UDOT has made a strategic decision to pursue Accelerated Bridge Construction techniques. Accelerated Bridge Construction has many benefits but requires new construction methods. One of the Accelerated Bridge Construction techniques is to build the structure offsite and move it into place. On multi-span structures it becomes difficult to connect precast bent sections and /or precast superstructures to substructures. Previous solutions have used posttensioning, rebar splice sleeves or complicated closure pours.

One solution that has been overlooked and under utilized by the bridge industry is isolation bearings, which eliminate the need for the full connection. By building the columns in place, setting isolation bearings on the columns and setting the precast superstructure on the isolation bearings, all the connection concerns are eliminated. Isolation bearings can also be applied to achieve better performance in bridges with traditional construction techniques or in seismic retrofits. As an additional benefit, seismic performance is improved and substructure construction costs may be lowered due to reduced demands to the foundation.

UDOT has not utilized isolation bearings due to a lack of knowledge and understanding of 1) how isolation bearings work, 2) how to design for isolation bearings and 3) how to incorporate isolation bearings on bridge plans. This ultimate objective of this project is to develop a design process, standard drawings and standard specifications for isolation bearings.

2. Strategic Goal: ☐ Preservation ☒ Operation ☐ Capacity ☒ Safety (check all that apply)

3A. List the research objective(s) to be accomplished:

1. Develop design guidelines for seismic isolation bearings.
2. Develop design examples using different types of seismic isolation bearings.
3. Educate the bridge design community on the use of seismic isolation bearings

3B. List the major tasks to accomplish the research objective(s): **Estimated person-hours:**

1. Review of existing literature on design guidelines for seismically isolated bridges and data from bearing manufacturers.
2. Document properties, performance, and best applications for different seismic isolation bearings available.
3. Select one or more bearing types as approved systems for UDOT, based on cost and performance.
4. Develop design guidelines and modeling techniques for different types of isolation bearings.
5. Explain how to specify on plans isolation bearing properties. Develop standard drawings and specifications.
6. Prepare a report outlining the findings of the study, including all guidelines.
7. Train designers on the theory, applications, design and specification of isolation bearings.

4. Estimate the cost of this research study including implementation effort (use person-hours from No. 3B): $41,000

5. Indicate type of research and/or development project this is

Large: ☐ Research Project ☒ Development Project
Small: ☐ Research Evaluation ☐ Experimental Feature ☐ New Product Evaluation ☐ Tech Transfer Initiative
☐ Other: _____

(A small project is usually less than $20,000 and shorter than 6 months)

6. Outline the proposed schedule (when do you need this done, and how will we get there):

Task 1: 2 month
Task 2: 1.5 month
Task 3: 0.5 month
Task 4: 4 months
Task 5: 1 month
Task 6: 2 months
Task 7: 1 month

7. What type of entity is best suited to perform this project (University, Consultant, UDOT Staff, Other Agency, Other)?

Consultant, UDOT, University joint venture.
University to perform literature search and prepare design guidelines and examples.
Consultant to provide standard drawings and provide real bridge application to prepare design example.

8A. What deliverables would you like to receive at the end of this project? (e.g. useable technical product, design method, technique, training, workshops, report, manual of practice, policy, procedure, specification, standard, software, hardware, equipment, training tool, etc.)

The deliverable is a report including design and modeling guidelines and specification standards for isolation bearings.

8B. Describe how this project will be implemented at UDOT.

UDOT engineers and consultants will be trained on the guidelines and standards for isolation bearings.

8C. Describe how UDOT will benefit from the implementation of this project, and who the beneficiaries will be.

Design for isolation bearings will be standardized reducing design costs. Engineers will have access to a new technique that is applicable to all designs and very conducive to accelerated bridge construction techniques in particular. Use of isolation bearings will improve seismic performance and potentially reduce substructure construction costs due to a reduction in footing size and number of piles.

9. Describe the expected risks and obstacles as well as the strategies to overcome them.

The major risk in any research project is the deliverable is never used. By creating a team of real world professionals, and academic professionals we will get the best of both worlds to create a document that recognizes the needs of design engineers and is backed by peer reviewed research.

10A. List other people (UDOT and non-UDOT) who are willing to participate in the Technical Advisory Committee (TAC) for this study:

Name	Organization / Division / Region	Phone	Email
Hugh Boyle	Baker Corp.		

10B. Identify other Utah, regional, or national agencies and other groups that may have an interest in supporting this study:

FHWA Highways for Life program may be interested in this project.